

# SYS86350V4GA

***(v1.x) Industrial Computer Board***



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# 1 Overview

Thank you for choosing the SYS86350V4GA, an excellent industrial computer board.

Based on the innovative Intel® H81/ Q87 chipset for optimal system efficiency, the 86350 accommodates the Intel® Haswell processor and supports up to 2 DDR3/DDR3L 1333/1600 MHz SO-DIMM slots to provide the maximum of 16 GB memory capacity.

In the advanced-level and mid-range market segment, 86350 provides a high-performance solution for today's front-end and general purpose workstation, as well as in the future.

# Mainboard Specifications

## Processor

- 4th generation Intel Core i3/ i5/ i7, Pentium, Celeron processor (LGA1150)

## Chipset

- SKU1, SKU2: Intel H81
- SKU3: Intel Q87

## Memory

- 2 x DDR3/DDR3L 1333/1600 MHz SO-DIMM slots
- Up to 16 GB
- Dual-Channel mode

## LAN

- SKU1
  - LAN1: Intel I210-AT Gigabit Fast Ethernet controller
  - LAN2: Intel I210-AT Gigabit Fast Ethernet controller
  - LAN3: Intel I210-AT Gigabit Fast Ethernet controller
  - LAN4: Intel I210-AT Gigabit Fast Ethernet controller
- SKU2, SKU3
  - LAN1: Intel I211-AT Gigabit Fast Ethernet controller
  - LAN2: Intel I211-AT Gigabit Fast Ethernet controller

## SATA

- 2 x SATA 6Gb/s ports
- 1 x mSATA slot (shared with full-size Mini-PCIe slot)

## Audio

- Realtek ALC887 audio codec
- 1 x front audio connector
- 1 x amplifier connector

## Graphics

- Graphics integrated in Intel processor

## Rear Panel I/O

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| ■ SKU1                               | ■ SKU2, SKU3                         |
| - 1 x PS/2 mouse/keyboard combo port | - 1 x PS/2 mouse/keyboard combo port |
| - 2 x VGA ports                      | - 2 x VGA ports                      |
| - 4 x RJ45 GbE LAN ports             | - 2 x RJ45 GbE LAN ports             |
| - 4 x USB 2.0 ports                  | - 4 x USB 2.0 ports                  |
| - 2 x USB 3.0 ports                  | - 2 x USB 3.0 ports                  |
| - 1 x DVI-D port                     | - 1 x DVI-D port                     |
| - 1 x HDMI port                      | - 1 x HDMI port                      |

## Onboard Headers/ Connectors/ Jumpers

### ■ SKU1

- 1 x 4-pin power connector
- 1 x 24-pin power connector
- 1 x system fan connector
- 1 x CPU fan connector
- 2 x SATA 6Gb/s ports
- 1 x USB 2.0 connector (2 ports)
- 2 x RS-232/422/485 serial port connectors (2 ports)
- 1 x RS-232 serial port header (4 ports)
- 1 x GPIO connector
- 1 x front panel header
- 2 x LAN LED connectors
- 1 x front audio connector
- 1 x amplifier connector
- 1 x clear CMOS jumper
- 3 x serial port power jumpers
- 1 x AT/ATX select jumper
- 4 x non-volatile memory jumpers

### ■ SKU2, SKU3

- 1 x 4-pin power connector
- 1 x 24-pin power connector
- 1 x system fan connector
- 1 x CPU fan connector
- 2 x SATA 6Gb/s ports
- 1 x USB 2.0 connector (2 ports)
- 2 x RS-232/422/485 serial port connectors (2 ports)
- 2 x RS-232 serial port header (8 ports)
- 1 x GPIO connector
- 1 x front panel header
- 1 x LAN LED connector
- 1 x front audio connector
- 1 x amplifier connector
- 1 x clear CMOS jumper
- 4 x serial port power jumpers
- 1 x AT/ATX select jumper
- 2 x non-volatile memory jumpers

## Slot

- 1 x PCIe x16 slot (Gen2 for H81, Gen3 for Q87)
- 1 x full-size Mini-PCIe slot (MINI\_PCIE1, shared with mSATA)
- 1 x half-size Mini-PCIe slot (MINI\_PCIE2)

## Form Factor

- Mini-ITX: 170 mm x 170 mm

## Environmental

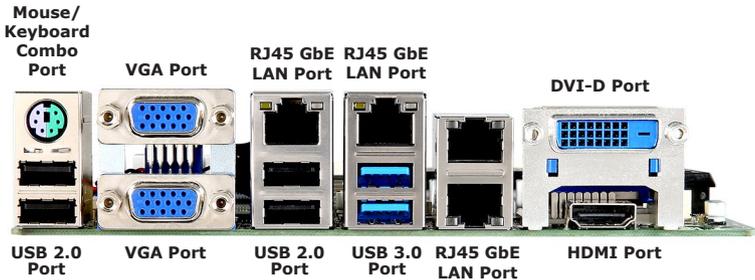
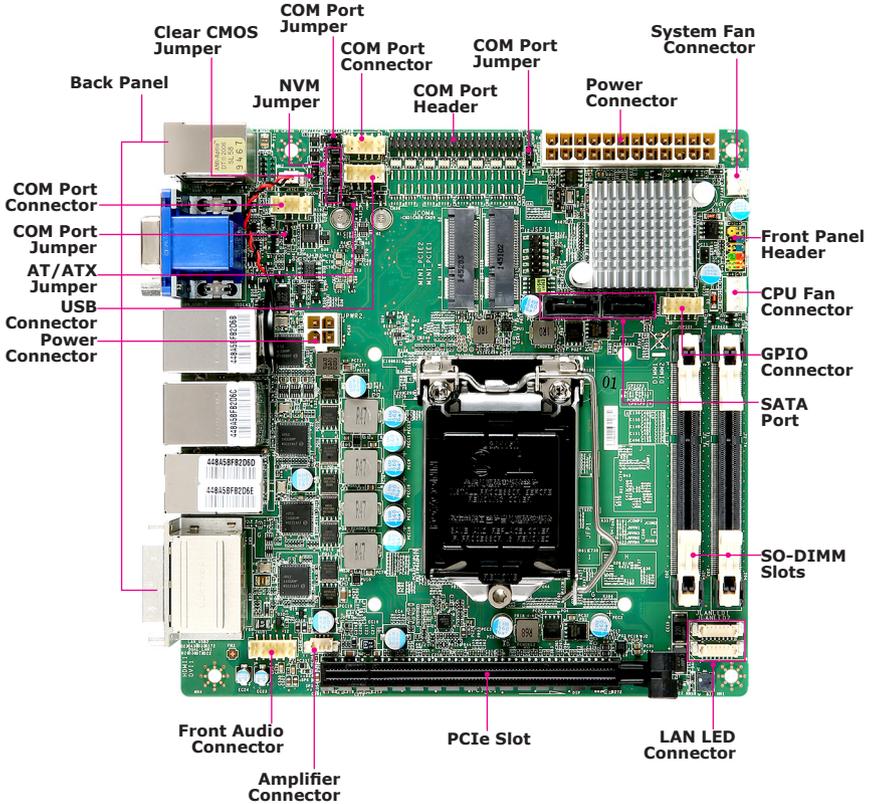
- Operating Temperature: -10 ~ 60°C
- Storage Temperature: -20 ~ 80°C
- Humidity: 5 ~ 95% RH, non-condensing

## SKU Comparison

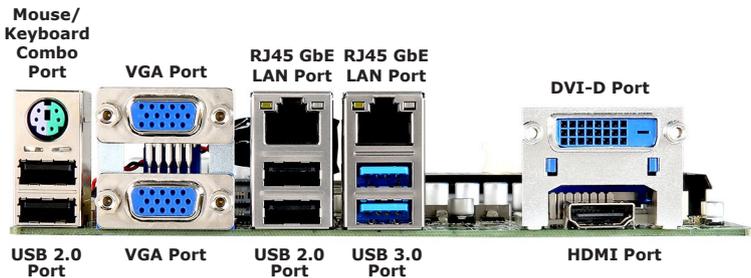
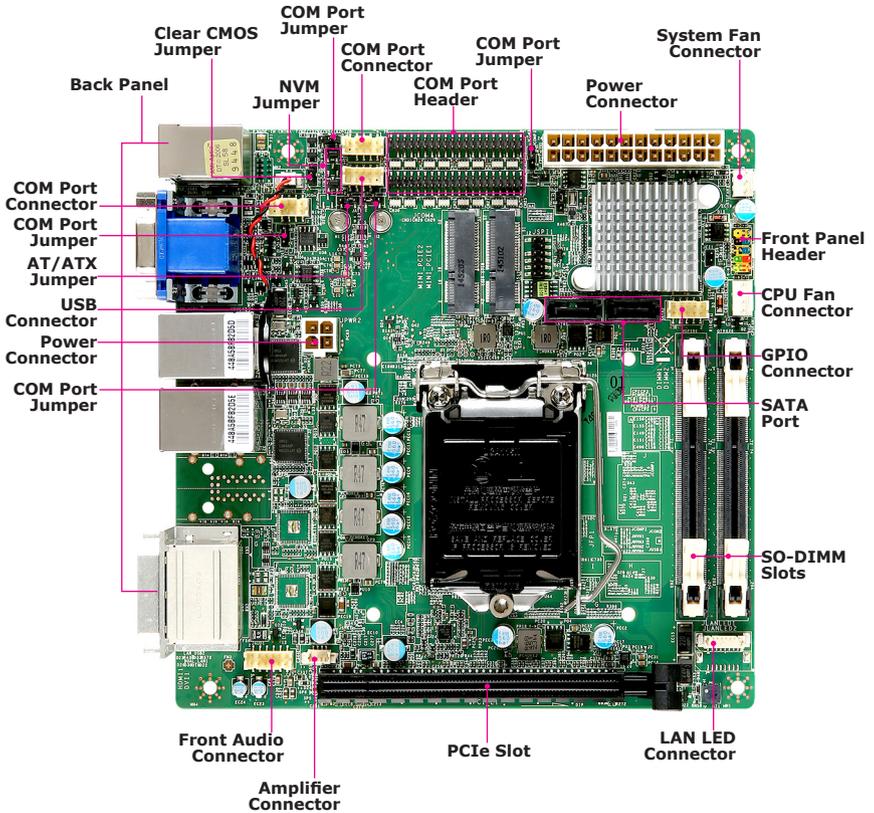
SKUs	SKU1	SKU2	SKU3
Features			
PCH	H81	H81	Q87
LAN port	4	2	2
COM port	6	10	10

# Mainboard Layout

## SYS86350V4GA SKU1



# SYS86350VGGA-10C SKU2, SKU3



# 2 Hardware Setup



This chapter provides you with the information about hardware setup procedures. While doing the installation, be careful in holding the components and follow the installation procedures. For some components, if you install in the wrong orientation, the components will not work properly.

Use a grounded wrist strap before handling computer components. Static electricity may damage the components.

# Components Reference Guide

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# CPU (Central Processing Unit)

When installing the CPU, make sure that you install the cooler to prevent overheating. If you do not have the CPU cooler, consult your dealer before turning on the computer.

## Important

### **Overheating**

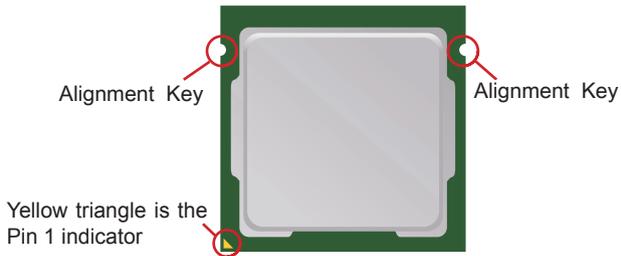
*Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.*

### **Replacing the CPU**

*While replacing the CPU, always turn off the power supply or unplug the power supply's power cord from the grounded outlet first to ensure the safety of CPU.*

## Introduction to LGA 115x CPU

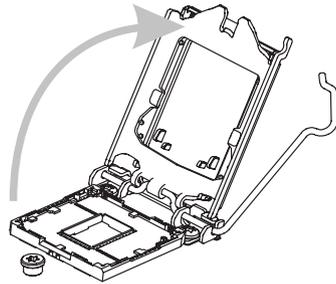
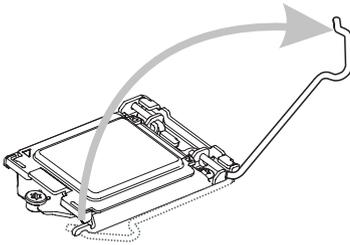
The surface of LGA 115x CPU. Remember to apply some thermal paste on it for better heat dispersion.



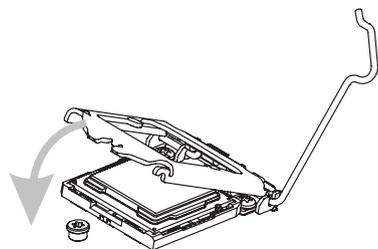
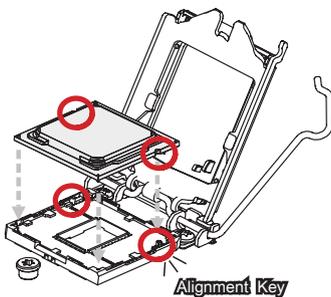
## CPU Installation

When you are installing the CPU, **make sure the CPU has a cooler attached on the top to prevent overheating**. Meanwhile, do not forget to apply some thermal paste on CPU before installing the heat sink/cooler fan for better heat dispersion.

1. Open the load lever and remove the plastic cap.
2. Lift the load lever up to fully open position.



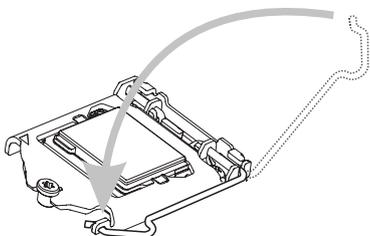
3. After confirming the CPU direction for correct mating, put down the CPU in the socket housing frame. Be sure to grasp on the edge of the CPU base. Note that the alignment keys are matched.
4. Engage the load lever while pressing down lightly onto the load plate.



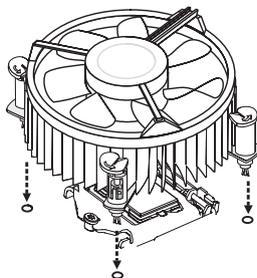
### **Important**

*Visually inspect if the CPU is seated well into the socket. If not, take out the CPU with pure vertical motion and reinstall.*

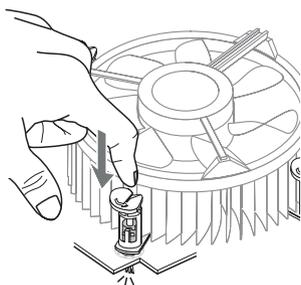
5. Secure the load lever with the hook under the retention tab.



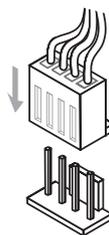
6. Make sure the four hooks are in proper position before you install the cooler. Align the holes on the motherboard with the cooler. Push down the cooler until its four clips get wedged into the holes of the motherboard.



7. Press the four hooks down to fasten the cooler. Turn over the motherboard to confirm that the clip-ends are correctly inserted.



8. Finally, attach the CPU Fan cable to the motherboard.



### **Important**

- Confirm if your CPU cooler is firmly installed before turning on your system.
- Do not touch the CPU socket pins to avoid damage.
- Whenever CPU is not installed, always protect your CPU socket pins with the plastic cap covered.
- Please refer to the documentation in the CPU cooler package for more details about the CPU cooler installation.
- Read the CPU status in BIOS.

# Memory

## Dual-Channel Mode

In Dual-Channel mode, make sure that you install memory modules of the **same type and density** in different channel DIMM slots.

## Recommended Memory Population

Number of DIMMs installed	1	2
DIMM1 (ch A)	V	V
DIMM2 (ch B)		V

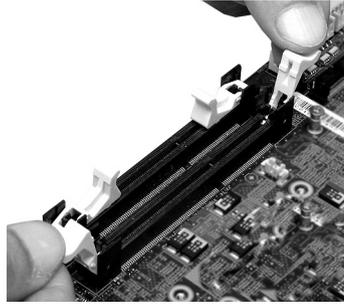
### **Important**

- "V" indicates a populated DIMM slot.
- Paired memory installation for Max performance.
- Populate the same DIMM type in each channel, specifically: 1. Use the same DIMM size; 2. Use the same number of ranks per DIMM.

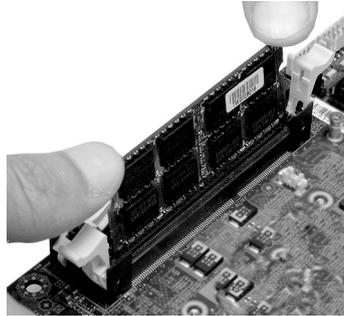
## Installing Memory Modules

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1. Unlock the DIMM slot by flipping open its side clips.



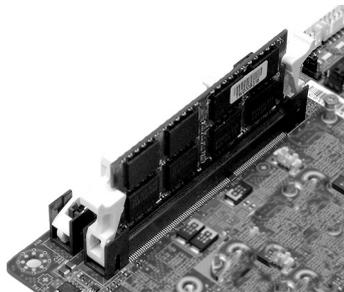
2. Vertically insert the DIMM into the DIMM slot. The DIMM has an off-center notch at the bottom that will only allow it to fit one way into the DIMM slot. Push the DIMM deeply into the DIMM slot. The side clips of the slot will automatically close when the DIMM is properly seated and an audible click should be heard.



3. Manually check if the DIMM has been locked in place by the DIMM slot's side clips.

### **Important**

- *Motherboard photos shown in this section are for demonstration only and may differ from the actual look of your motherboard.*
- *You can barely see the golden finger if the DIMM is properly inserted in the DIMM slot.*



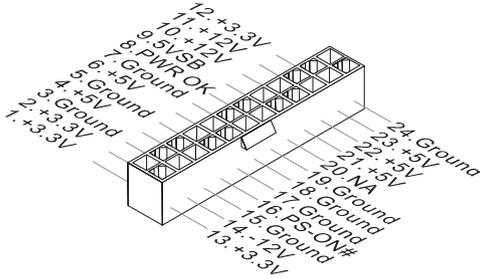
### **Important**

*To enable successful system bootup, always insert the memory module into the DIMM1 first.*

# Power Supply

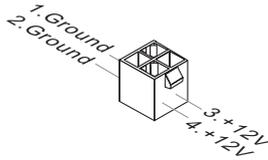
## System Power Connector: JPWR1

This connector allows you to connect a power supply. To connect to the power supply, make sure the plug of the power supply is inserted in the proper orientation and the pins are aligned. Then push down the power supply firmly into the connector.



## CPU Power Connector: JPWR2

This connector is used to provide power to the CPU.

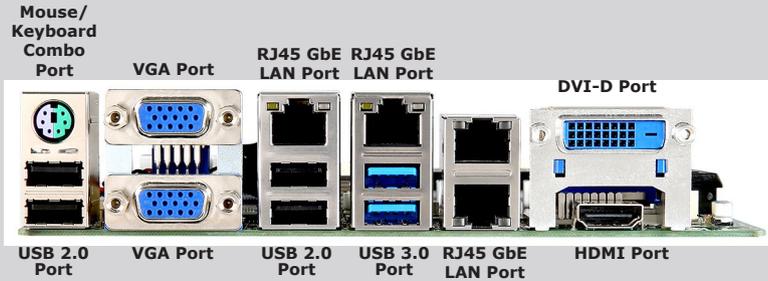


### **Important**

*Make sure that all power connectors are connected to the power supply to ensure stable operation of the motherboard.*

# Rear Panel I/O

## SKU1



## SKU2, SKU3



### ➤ Mouse / Keyboard Combo Port

The standard PS/2<sup>®</sup> mouse/keyboard DIN connector is for a PS/2<sup>®</sup> mouse/keyboard.

### ➤ VGA Port

The DB15-pin female connector is provided for monitor.

### ➤ USB 2.0 Port

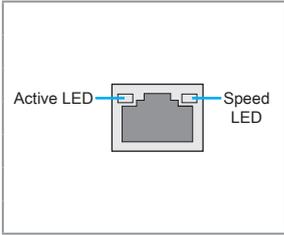
The USB (Universal Serial Bus) port is for attaching USB devices such as keyboard, mouse, or other USB-compatible devices.

### ➤ USB 3.0 Port

The USB 3.0 port is backward-compatible with USB 2.0 devices and supports data transfer rate up to 5 Gbit/s (SuperSpeed).

### ► RJ45 GbE LAN Port

The standard RJ45 LAN jack is provided for connection to the Local Area Network (LAN). You can connect a network cable to it.

	LED	LED Status	Description
	Active LED	Off	No link
		Yellow	Linked
		Blinking	Data activity
	Speed LED	Off	10 Mbps connection
		Green	100 Mbps connection
Orange		1 Gbps connection	

### ► DVI-D Port

The DVI-D (Digital Visual Interface-Digital) connector allows you to connect an LCD monitor. It provides a high-speed digital interconnection between the computer and its display device. To connect an LCD monitor, simply plug your monitor cable into the DVI connector, and make sure that the other end of the cable is properly connected to your monitor (refer to your monitor manual for more information.)

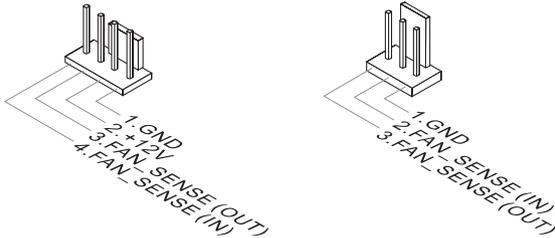
### ► HDMI Port **HDMI™**

The High-Definition Multimedia Interface (HDMI) is an all-digital audio/video interface capable of transmitting uncompressed streams. HDMI supports all TV format, including standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable.

# Connector

## Fan Power Connector: CPUFAN1, SYSFAN1

The fan power connectors support system cooling fan with +12V. When connecting the wire to the connectors, always note that the red wire is the positive and should be connected to the +12V; the black wire is Ground and should be connected to GND. If the motherboard has a System Hardware Monitor chipset onboard, you must use a specially designed fan with speed sensor to take advantage of the CPU fan control.

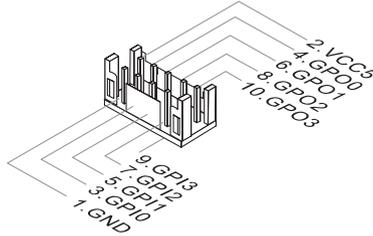


### **Important**

- Please refer to the recommended CPU fans at processor's official website or consult the vendors for proper CPU cooling fan.
- Fan cooler sets with 3- or 4-pin power connector are both available.

### GPIO Connector: JGPIO1

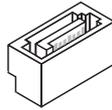
This connector is provided for the General-Purpose Input/Output (GPIO) peripheral module.



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### Serial ATA Connector: SATA1, SATA2

This connector is a high-speed Serial ATA interface port. Each connector can connect to one Serial ATA device.

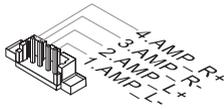


#### **Important**

*Please do not fold the SATA cable into a 90-degree angle. Otherwise, data loss may occur during transmission.*

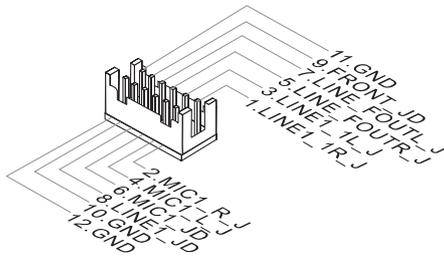
## Audio Amplifier Connector: JSPK1

The connector is used to connect audio amplifiers to enhance audio performance.



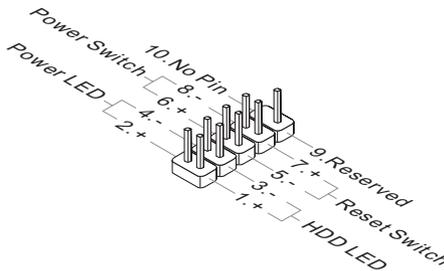
## Front Audio Connector: JAUD1

This connector allows you to connect the front panel audio and is compliant with Intel Front Panel I/O Connectivity Design Guide.



## Front Panel Header: JFP1

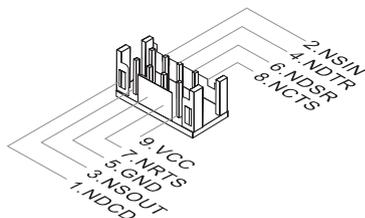
This front panel connector is provided for electrical connection to the front panel switches & LEDs and is compliant with Intel Front Panel I/O Connectivity Design Guide.



## RS-232/422/485 Serial Port Connector: JCOM1, JCOM2

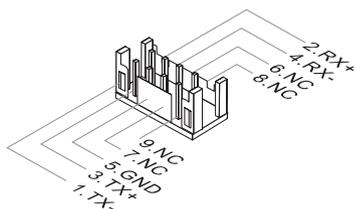
This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach a serial device to it through an optional serial port bracket.

### RS-232



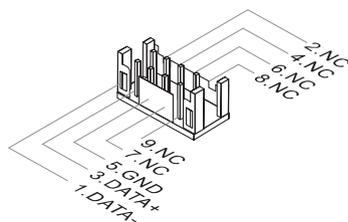
PIN	SIGNAL	DESCRIPTION
1	NDCD	Data Carrier Detect
2	NSIN	Signal In
3	NSOUT	Signal Out
4	NDTR	Data Terminal Ready
5	GND	Signal Ground
6	NDSR	Data Set Ready
7	NRTS	Request To Send
8	NCTS	Clear To Send
9	VCC	5V or 12V selected by jumper
10	NC	No Connection

### RS-422



PIN	SIGNAL	DESCRIPTION
1	422 TXD-	Transmit Data, Negative
2	422 RXD+	Receive Data, Positive
3	422 TXD+	Transmit Data, Positive
4	422 RXD-	Receive Data, Negative
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection
10	NC	No Connection

### RS-485

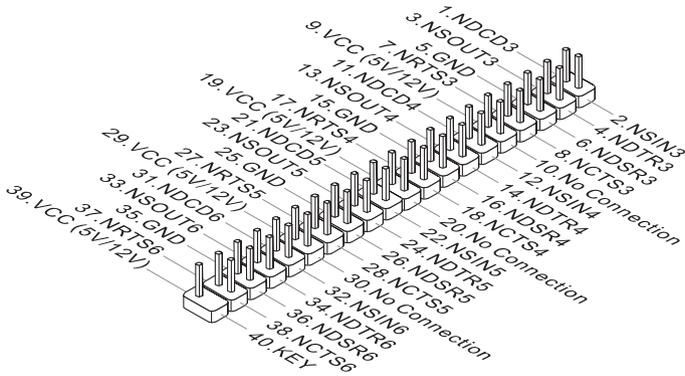


PIN	SIGNAL	DESCRIPTION
1	485 TXD-	Transmit Data, Negative
2	NC	No Connection
3	485 TXD+	Transmit Data, Positive
4	NC	No Connection
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection
10	NC	No Connection

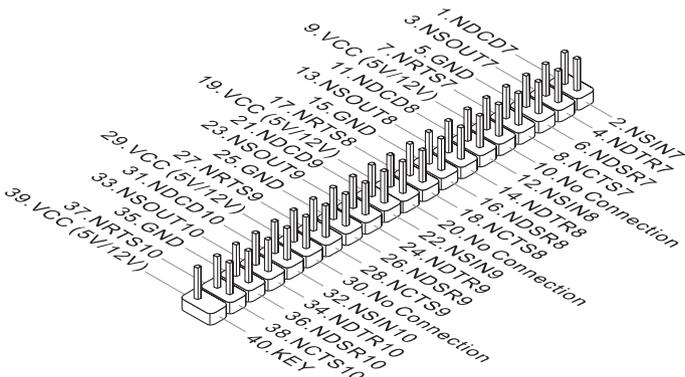
## RS-232 Serial Port Header: JCOM3, JCOM4 (JCOM4 for SKU2, SKU3 only)

This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach serial devices to it through the optional serial port bracket.

### JCOM3

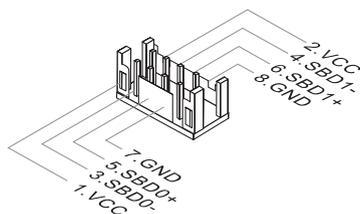


### JCOM4



## USB 2.0 Connector: JUSB1

This connector, compliant with Intel I/O Connectivity Design Guide, is ideal for connecting high-speed USB interface peripherals such as USB HDD, digital cameras, MP3 players, printers, modems and the like.

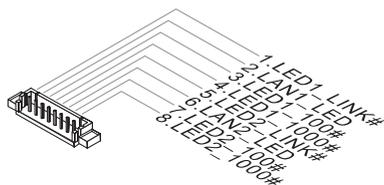


### **Important**

Note that the pins of VCC and GND must be connected correctly to avoid possible damage.

## LAN LED Connector: JLANLED1, JLANLED2 (JLANLED2 for SKU1 only)

This connector is used to connect LAN LEDs.



# Jumper

## Important

Avoid adjusting jumpers when the system is on; it will damage the motherboard.

---

### Clear CMOS Jumper: JCMOS1

There is a CMOS RAM onboard that has a power supply from an external battery to keep the data of system configuration. With the CMOS RAM, the system can automatically boot OS every time it is turned on. If you want to clear the system configuration, set the jumper to clear data.



## Important

You can clear CMOS by shorting 2-3 pin while the system is off. Then return to 1-2 pin position. Avoid clearing the CMOS while the system is on; it will damage the motherboard.

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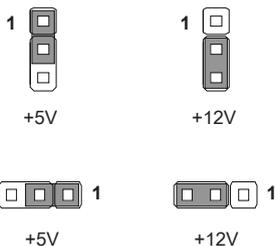
### AT/ATX Select Jumper: JAT1

This jumper allows users to select between AT and ATX power.



### Serial Port Power Jumper: JCOMP1, JCOMP2, JCOMP3, JCOMP4 (*JCOMP4 for SKU2, SKU3 only*)

These jumpers specify the operation voltage of the onboard serial ports.




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### Non-Volatile Memory Jumper: JNVM1, JNVM2, JNVM3, JNVM4 (*JNVM3, JNVM4 for SKU1 only*)

This jumper is used to enable/disable the BIOS flash. When you intend to update the BIOS code, short connect pin#2-3 first. Under normal operation, we suggest that you enable the BIOS flash protection by short connecting pin#1-2 to protect the system BIOS from virus infection.



# 3 HIDAC Utility

This section introduces the GT HIDAC utility for overall system monitor and control.

# Activating the Utility

Select [GT HIDAC Utility] on Desktop to activate the utility.

This GT HIDAC Utility provides information on:

- GPIO (DIO)
- Watchdog Timer
- System Information
- Hardware Monitor
- Alarm Settings for Hardware Monitor
- Alarm Logs for Hardware Monitor

## GPIO (DIO)

**Features:**

- 4 GPIs and 4 GPOs available
- Real-time display of GPIO status
- Selectable GPO status

# Watchdog

## Features:

- Initial Timer configurable through **WDT Settings**
- **WDT Tools** available for automatically activating Watchdog Timer at system boot and automatically resetting timer after a preset time interval
- Real-time display of Watchdog Timer status

# System Info.

## Features:

- Real-time display of *System Information, Platform Information, Utility Information, Memory Information and Disk Drive Usage Information*

# HW Monitor

**Features:**

- Real-time display of Hardware Monitor status including CPU/system temperatures, fan speeds and voltages

# Alarm Settings

**Features:**

- Custom settings of a tolerance range for the alarm triggers
- Automatic alarm logs of monitored hardware items when the alarm trigger thresholds are exceeded

# Alarm Logs

## Features:

- Real-time display of Hardware Monitor alarm logs
- Alarm logs filterable by button (Information, Warning or Error)
- Alarm logs clearable through ***Clear Logs***

# *Appendix*

# WDT & GPIO



This appendix provides the sample codes of WDT (Watch Dog Timer) and GPIO (General Purpose Input/ Output).

## WDT Sample Code

```

SIO_INDEX_Port    equ 04Eh
SIO_DATA_Port     equ 04Fh
SIO_UnLock_Value  equ 087h
SIO_Lock_Value    equ 0AAh
WatchDog_LDN      equ 007h
WDT_UNIT          equ 60h      ;60h=second, 68h=minute, 40h=Disabled watchdog timer
WDT_Timer         equ 30      ;ex. 30 seconds

```

Sample code:

```

;Enable config mode
mov dx, SIO_INDEX_Port
mov al, SIO_UnLock_Value
out dx, al
jmp short $+2          ;Io_delay
jmp short $+2          ;Io_delay
out dx, al

;Change to WDT
mov dx, SIO_INDEX_Port
mov al, 07h
out dx, al
mov dx, SIO_DATA_Port
mov al, WatchDog_LDN
out dx, al

;Active WDT
mov dx, SIO_INDEX_Port
mov al, 30h
out dx, al
mov dx, SIO_DATA_Port
in al, dx
or al, 01h
out dx, al

;set timer
mov dx, SIO_INDEX_Port
mov al, 0F6h
out dx, al
mov dx, SIO_DATA_Port
mov al, WDT_Timer
out dx, al

;set UINIT
mov dx, SIO_INDEX_Port
mov al, 0F5h
out dx, al
mov dx, SIO_DATA_Port
mov al, WDT_UNIT
out dx, al

;enable reset
mov dx, SIO_INDEX_Port
mov al, 0FAh
out dx, al
mov dx, SIO_DATA_Port
in al, dx
or al, 01h
out dx, al

;close config mode
mov dx, SIO_INDEX_Port
mov al, SIO_Lock_Value
out dx, al

```

# GPIO Sample Code

- GPI 0 ~ GPI 3

	GPI 0	GPI 1	GPI 2	GPI 3				
IO Address	1C3Ah	1C0Eh	1C38h	1C38h				
SIO GPIO Register								
Bit	0	6	2	3				
Sample code	#1							

- GPO 0 ~ GPO 3

	GPO 0	GPO 1	GPO 2	GPO 3				
IO Address	1C0Ch	1C0Ch	1C0Ch	1C0Eh				
SIO GPIO Register								
Bit	1	6	7	1				
Sample code	#2							

```

GPI_REG      equ    1C3Ah
GPO_REG      equ    1C0Ch
GPO_0        equ    00000010b
    
```

---

## Sample Code:

### #1 : Get GPI 0 status

```

mov    dx, GPI_REG
in     al, dx
;al bit0 = GPI 0 status
    
```

### #2 : Set GPO 0 status to high

```

mov    dx, GPO_REG
in     al, dx
and    al, Not GPO_0    ;reset to 0
or     al, GPO_0
out    dx, al
    
```